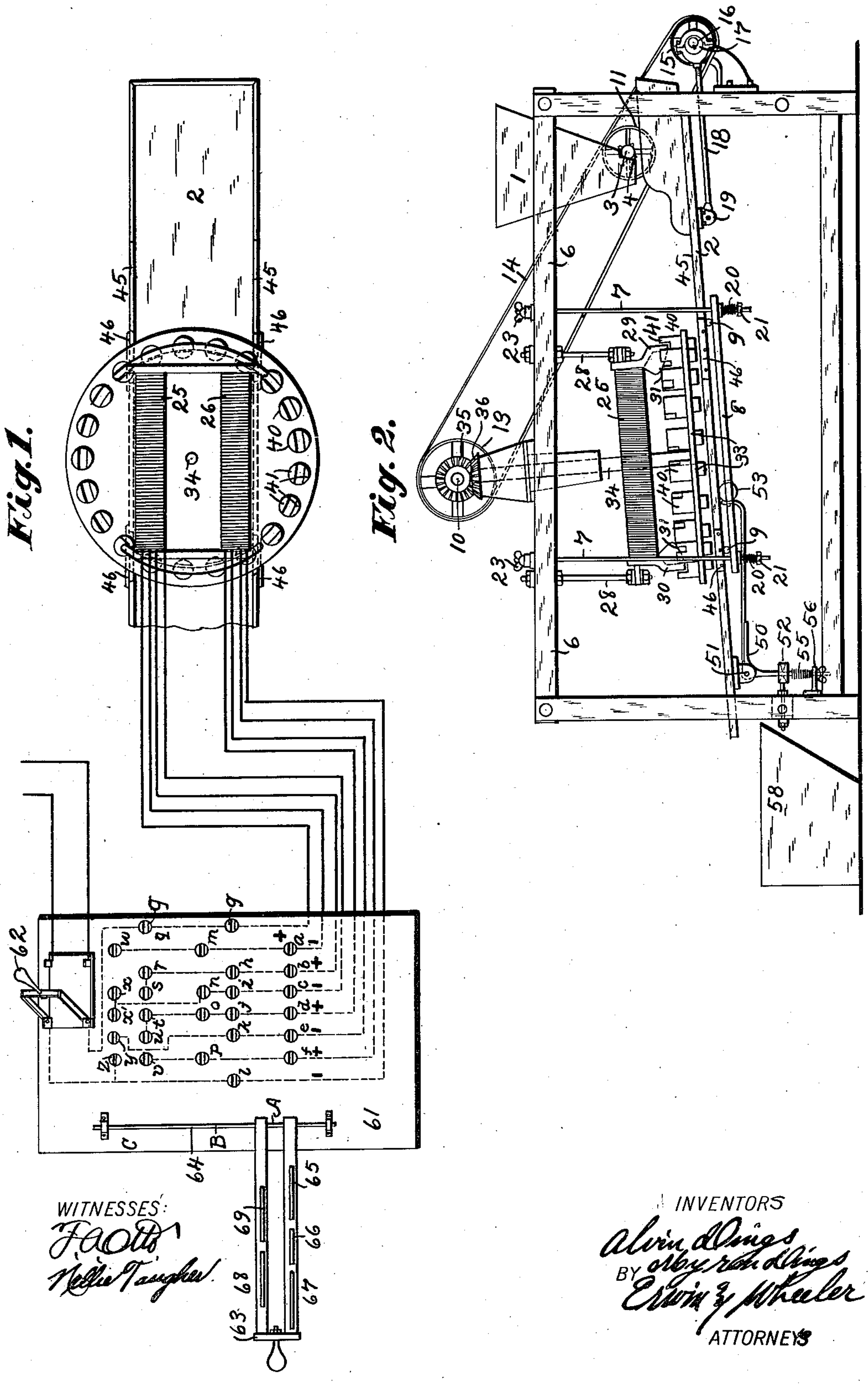
A. & M. DINGS.
MAGNETIC SEPARATOR.
APPLICATION FILED MAR. 16, 1905.

983,881. Patented Feb. 14, 1911.



WITNESSES:

INVENTORS
Alvin Dings
BY
Erwin & Wheeler
ATTORNEYS

UNITED STATES PATENT OFFICE.

ALVIN DINGS AND MYRON DINGS, OF MILWAUKEE, WISCONSIN, ASSIGNORS TO DINGS ELECTRO-MAGNETIC SEPARATOR CO., OF MILWAUKEE, WISCONSIN, A CORPORATION OF WISCONSIN.

MAGNETIC SEPARATOR.

983,881. Specification of Letters Patent. Patented Feb. 14, 1911.

Application filed March 16, 1905. Serial No. 250,349.

To all whom it may concern:

Be it known that we, ALVIN DINGS and MYRON DINGS, citizens of the United States, residing at Milwaukee, county of Milwaukee, and State of Wisconsin, have invented new and useful Improvements in Magnetic Separators, of which the following is a specification.

Our invention relates to improvements in magnetic separators.

The objects of our invention are: 1st, to provide means whereby a series of movable auxiliary magnets may be energized successively from a stationary magnet by induction, and in which the auxiliary magnets will not only be deënergized, but their polarity reversed in passing from one magnetic field to another, thus removing all residual magnetism; 2nd, to provide means whereby pieces of magnetite of irregular shape and size may be removed from a slide by means of magnets traveling over the surface of such slide and such removal accomplished without clogging the machinery, or injuring the slide or magnets; 3rd, to provide means for increasing the intensity of the magnetic field through an auxiliary magnet, located on the other side of the slide from that of the magnets which carry the material; 4th, to provide means for effectively distributing the magnetite on the surface of the slide underneath the magnetic carriers; 5th, to provide means whereby the intensity of the magnetic field may be varied by changing the path of the current in the magnetic windings.

In the following description reference is had to the accompanying drawings, in which—

Figure 1 is a plan view of a portion of the slide, the stationary magnet and the magnetic carrier, provided with auxiliary magnets, together with the switch board used for varying the intensity of the magnetic field. Fig. 2 is a side view of our invention, the switch board being omitted.

Like parts are identified by the same reference characters in both views.

The material is fed into a hopper 1, from which it is discharged to an inclined platform or slide 2. A rotary feed roller 3, provided with feeding projections 4, is preferably located at the discharge opening of the hopper, whereby a uniform feed of material from the hopper to the slide is secured. The slide is suspended from a frame 6 by means of hanger-bars 7 and a platform 8 upon which the slide is mounted, with interposed rollers 9, which permit a longitudinal movement of the slide without material friction. Motion is transmitted to the slide from any suitable source of power through the medium of a shaft 10, pulley 13, belt 14 and pulley 15, shaft 16, eccentric 17, and a pitman bar 18, the latter having jointed connection with the slide at 19. Motion is transmitted to the roller 3 from the belt 14 by means of a pulley 11 mounted on said roller.

A platform 8 is loosely mounted on the rods 7 and is supported from the rods by springs 20, interposed between the nuts 21 and the platform which permit it to move vertically on the rods 7. The rods themselves may be vertically adjusted in the frame 6 by means of thumb nuts 23. A stationary magnet, preferably having two cores 25 and 26 is supported from the frame by means of hanger-bars 28. This magnet is provided with segmental polar extremities 29 and 30 respectively, the ends of the pole pieces being rounded off as indicated at 31.

A non-magnetic carrier 33, preferably in the form of a disk, is supported from the frame by means of a driving shaft 34, to which motion is communicated from the shaft 10 by means of the gear wheels 35 and 36. Auxiliary magnets 40 are mounted on the disk 33 and extend through apertures in the disk, the lower ends of the auxiliary magnets being in close proximity to the surface of the slide 2. The upper ends of the auxiliary magnets are forked and the pole pieces 29 are formed to extend between the arms 41 of these forks and in close proximity to the arms, without actual contact therewith, whereby the auxiliary magnets 40, which are in registry with one of the pole pieces, become intensely magnetic by induction. The sides of the slide are provided with raised margins 45 which prevent the material from falling off. These marginal projections 45 are omitted along the paths of the auxiliary magnets and strips of flexible material 46, preferably of rubber or leather are substituted therefor, whereby the larger pieces of magnetite may be carried from the slide by the auxiliary magnets, for the flexible strips 46 will yield to permit the passage of the magnetite.

The slide 2 is caused to vibrate vertically by means of an elbow lever 50 pivoted at 51 to the under surface of the slide and having one arm loosely engaged in a bearing at 52. The other arm of the elbow lever is provided with a resilient cushion 53, preferably of rubber, which is supported by the arm of the lever 50 in a position to strike the under surface of the slide, when the elbow lever is actuated by the longitudinal vibratory slide movement. A spring 55 connects the downwardly extending arm of the lever 50 with a projection 56 on the frame. This spring is used to steady the slide. It may, if desired, be connected directly with the slide 2 instead of being attached to the elbow lever.

In operation, the material is fed from the hopper 1 to the slide and passes down along the slide, upon which it becomes thoroughly distributed before reaching the magnetic field, where the auxiliary magnets 40 collect the magnetite and carry it laterally from the surface of the slide, where it is discharged in a neutral zone between the pole pieces 29 and 30. The non-magnetic material passes on down the slide to a receiving bin 58. The slide is of non-magnetic material. The platform 8 is preferably of magnetic material whereby the intensity of the magnetic field through which the material passes is increased. The magnetic wire is wound in sections and the 2 cores or coils 25 and 26 so wound that their adjacent ends are of the same polarity. The terminals of the windings are connected to clips *a* to *z* inclusive on the switch panel 61. The clips are electrically connected as shown by dotted lines in Fig. 1.

62 is a service switch for closing an electrical circuit through the magnet coils; while 63 is a controlling switch for regulating the path of the electrical current through the coils to vary the intensity of the magnetic field. The switch 63 is slidingly connected with the rod 64 along which the switch may be swung into and out of contact with the clips. The switch 63 is of non-conducting material, but is provided with contact blades 65, 66, 67, 68 and 69 of copper or other suitable conducting material as shown. This switch is in the form of a fork with the contact blades 65, 66 and 67 on one arm and the blades 68 and 69 on the other arm. The switch 63 is adjusted in three positions along the rod 64, these positions being indicated at A, B, and C. When the switch is at A, if swung to circuit closing position, the blades 68 and 69 will not be in contact with any of the clips. The blades 65, 66 and 67 will contact with clips at *a*, *b*, *c*, *d*, *e* and *f*. The blade 65 will connect the clips *a* and *b*. The blades 66 will connect the clips *c* and *d*, and the blade 67 will connect the clips *e* and *f*; the effect of these connections being to place all the coils of the electromagnet in series. When the switch 63 is at B, if swung to circuit closing position, the blade 65 will connect clips at *g* and *h*. The blade 66 will connect the similar clips at *i* and *j* and the blade 67 will connect the clips at *k* and *l*. The blade 68 will connect the clips at *m* and *n* and the blade 69 will connect the clips at *o* and *p*. The effect of these connections will be to place the coils of each magnet core 25 and 26 in series, while the respective legs will be connected in parallel. When the switch 63 is at C, if adjusted to circuit closing position, the blade 65 will connect the clips at *q* and *r*. The clip at *s* is back-connected with *r* as indicated by dotted lines, and the blade 66 will connect the clip at *s* with the clip at *t*, the latter clip being back-connected with the clip *u* as indicated by dotted lines. The blade 67 connects the clip at *u* with the clip at *v*. The blade 68 connects the clip at *w* with the clip at *x*, the latter being back-connected with the clip at *x'*. The blade 69 connects the clip at *x'* with the clip at *y* and *z*, the latter being back-connected with the return circuit wire leading to the switch 62 as indicated by dotted lines. When the switch 63 is in this position, all of the windings of the electro magnet are connected in parallel.

With the described construction, three variations in the intensity of the magnet field can be secured, according as the magnet windings are connected in series, or partly in parallel, or wholly in parallel. It will of course be understood that if desired the switch board may be arranged for two variations, or for a greater number of variations, the complexity of the switch board connections being diminished or increased in proportion to the number of possible variations. The intensity of the field is thus varied in correspondence with the character of the material to be supported. Such variations have heretofore been secured through the medium of a rheostat with consequent loss of energy.

Having thus described our invention what we claim as new and desire to secure by Letters Patent is:

1. In a magnetic separator, the combination of a conveyer, an electromagnet above the conveyer, with its axis extending substantially longitudinally thereof, and having pole pieces at its respective ends, an interposed rotary carrier of greater diameter than the width of the conveyer, and a set of auxiliary pole pieces mounted on the car-

rier,—said carrier pole pieces being arranged to travel in a circular path substantially parallel to the surface of the conveyer and into and out of proximity to the pole pieces of the electromagnet.

2. In a magnetic separator, the combination of a conveyer, an electromagnet above the conveyer, with its axis extending substantially longitudinally thereof, and having pole pieces at its respective ends, an interposed rotary carrier of greater diameter than the width of the conveyer, and a set of auxiliary pole pieces mounted on the carrier,—said carrier pole pieces being arranged to travel in a circular path substantially parallel to the surface of the conveyer and into and out of proximity to the pole pieces of the electromagnet, the main and auxiliary pole pieces being arranged with a plurality of proximate faces.

3. In a magnetic separator, the combination of a conveyer, an electromagnet above the conveyer, with its axis extending substantially longitudinally thereof, and having pole pieces at its respective ends, an interposed rotary carrier of greater diameter than the width of the conveyer, and a set of auxiliary pole pieces mounted on the carrier,—said carrier pole pieces being arranged to travel in a circular path substantially parallel to the surface of the conveyer and into and out of proximity to the pole pieces of the electromagnet, together with a platform of magnetizable material supporting the conveyer.

4. In a magnetic separator, the combination of a conveyer, an electromagnet above the conveyer, with its axis extending substantially longitudinally thereof, and having pole pieces at its respective ends, an interposed rotary carrier of greater diameter than the width of the conveyer, and a set of auxiliary pole pieces mounted on the carrier,—said carrier pole pieces being arranged to travel in a circular path substantially parallel to the surface of the conveyer and into and out of proximity to the pole pieces of the electromagnet, together with a platform of magnetizable material supporting the conveyer, and means for adjusting the platform toward and away from the carrier.

5. In a magnetic separator, the combination of a supporting frame, a platform of magnetic material resiliently supported by said frame, a non-magnetic conveyer movably mounted on said platform, means for feeding material to be separated to said conveyer, means for actuating the conveyer, a stationary magnet in proximity to the conveyer, a carrier interposed between the stationary magnet and the conveyer and extending laterally through a neutral zone at each side of the conveyer, and a series of auxiliary pole pieces mounted on said carrier.

6. In a magnetic separator, the combination with a stationary magnet provided with extended pole pieces, a conveyer extending underneath the respective pole pieces, a rotary disk axially supported between the pole pieces and having its margins extending beyond the conveyer on each side, an annular series of auxiliary pole pieces mounted upon the disk, and means for rotating said disk, said auxiliary pole pieces being provided with upwardly projecting arms adapted to move in close proximity to the side faces of the pole pieces of the stationary magnet.

7. In a magnetic separator, the combination of a stationary magnet provided with extended pole pieces, a conveyer mounted upon a resilient support and extending underneath the respective pole pieces, a rigid rotary disk axially supported between the pole pieces and provided with an annular series of auxiliary pole pieces adapted to move in interacting relation to the pole pieces of the stationary magnet, and means for rotating said disk.

8. In a magnetic separator, the combination of a conveyer, an electromagnet above the conveyer, provided with pole pieces, a carrier extending across the conveyer and revolving in a plane substantially parallel thereto, and a set of auxiliary pole pieces mounted on the carrier and each arranged to travel past each pole piece with a plurality of its faces in proximate relation to such pole piece when crossing the conveyer.

9. In a magnetic separator, the combination of a conveyor, an electromagnet having main pole pieces of opposite polarity above the conveyer, and an electrically isolated platform below the conveyer formed of material having efficient magnetic conductivity and extending from a point approximately below one pole piece to a point approximately below the other, together with means for adjusting said platform and conveyer into greater or less proximity to the electromagnetic pole pieces, and a rotary member interposed between said pole pieces and the conveyer and provided with a set of auxiliary pole pieces in positions to be carried across the conveyer, in proximity to the respective main pole pieces.

10. In a magnetic separator, the combination of a conveyer, electromagnetic pole pieces of opposite polarity longitudinally alined above the conveyer, and a platform below the conveyer formed of material having efficient magnetic conductivity and extending from a point approximately below one pole piece to a point approximately below the other, together with a rotary carrier interposed between said pole pieces and the conveyer substantially in the plane of its upper surface, and provided with auxiliary pole pieces in positions to pass successively

under opposite poles in opposite directions across the conveyer and over the respective ends of said platform.

11. In a magnetic separator, pairs of opposing stationary pole pieces, a conveyer extending between the pole pieces of each pair, a rotary disk axially supported between the pole pieces and having its margins extending beyond the conveyer on each side, an annular series of auxiliary pole pieces mounted upon the disk and means for rotating said disk, said auxiliary pole pieces being provided with upwardly projecting arms adapted to move in close proximity to the side faces of the upper pole pieces.

In testimony whereof we affix our signatures in the presence of two witnesses.

ALVIN DINGS.
MYRON DINGS.

Witnesses:
JAS. B. ERWIN,
LEVERETT C. WHEELER.